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his work represents is fourfold; the investigation of the phenomena of mental development of school children, especially those who are retarded, and (2) a clinic supplemented by a training school at the hospital, (3) the offering of practical work to those interested alike in teaching, medicine, social observation and training, and (4) the training of students for a new profession, namely that of the psychological expert who shall make his career in connection with the school system. The first number makes an attractive appearance, an interesting case of infantile stammering in a boy of twelve is well studied, a principal of a Philadelphia school describes a case of juvenile delinquency, the editor has a long article on university courses in psychology in general, but with special reference to this kind of work, while there is another department of book reviews, criticisms, notes, news and comments.

*The Philippine Journal of Science*, edited by PAUL C. FREER. Published by The Bureau of Science of the Government of the Philippine Islands. Manila, October, 1906. Vol. I, No. 8. pp. 791-08.

The Philippine Journal of Science, edited by Paul C. Freer, is an important part, one might almost say, of the Philippine question in this country. Some of its work is excellently done. It is generally rather more practical than scientific in its range and scope. It is plain, however, that the purpose of the editors is not limited to the utilitarian side, but the anthropology, folklore, flora, fauna, geology, rainfall, etc., of the islands are included.

*On the Functions of the Cerebrum; the frontal lobes*, by SHEPHERD IVORY FRANZ. Archives of Psychology. Edited by R. S. Woodworth. No. 2. March, 1907. New York, The Science Press. pp. 64.

The author first gives some account of the frontal lobes as centres of motion, inhibition, attention and intellectual states, then describes his own method and his results, which show loss of habit after extirpation of the frontals, the effect of surgical shock upon the attention, associations, the retention of habit after extirpation of parts of the cerebrum, the formation of association after removal of both frontal lobes, emotion, will, condition of animals from which the lobes have been removed and the nutrition.

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#### THE PROCEEDINGS OF THE PHILADELPHIA MEETING OF EXPERIMENTAL PSYCHOLOGISTS.

The fourth annual gathering of experimental psychologists was held at the University of Pennsylvania on April 17th and 18th, 1907. The papers were of a high degree of excellence, and the discussions which followed were interesting and illuminating. A novel feature of the programme was a round table discussion of the plans and methods of instruction in psychology. The visiting psychologists were invited to attend the meetings of the American Philosophical Society which were held in Philadelphia during the same week. Professor Witmer entertained the psychologists most hospitably at the University Club, and conducted them on tours of inspection through his unusually well-appointed laboratory.

In the session devoted to Comparative and Child Psychology the following papers were presented:

*Statistics of Retardation in a City School System*, by J. E. BRYAN.

A statistical study of data obtained from several thousand children

of all school-ages and school-grades. There comes to light a thorough-going parallelism between physical anomaly and mental retardation. (This paper has since appeared in full in the *Psychological Clinic*.)

*Clinical Examination of Retarded Children*, by J. D. HEILMAN.

A description of the mode of procedure followed in the examination of retarded children, and a presentation of certain results obtained, with illustrations from individual cases. The procedure consisted essentially in obtaining from the school records a list of pedagogically retarded children, and the preparation of a blank record-sheet for the systematic enumeration of data. In addition to the mental, physical and motor stigmata, these sheets recorded such data as home and family conditions, and school standing. The individual cases presented showed that the capacity of pedagogically retarded children may vary between the limits of good mentality and hopeless idiocy.

(1.) *Individual Variation in Acquisition and in Retention*, by E. J. MYER, and (2) *The Associative Processes of the Dog, the Cat and the Squirrel*, by S. S. COLVIN. (Presented by J. W. Baird.)

(1) Mr. Myer's investigation dealt with the differentiation of the memorial types in school children, and the relative memorial efficiency of the various types. His preliminary work had to do chiefly with a series of tests which should identify the type present in a given individual. This was followed by a series of experiments which aimed to determine the stability and the relative efficiency of the different types. In this preliminary report the tests employed were described and demonstrated. (2) Professor Colvin's research aimed to obtain quantitative determinations of the ability of certain animals to distinguish colors, and to establish associations between groups of memorial material. A series of boxes of uniform size and shape, but of different colors, was prepared and furnished with food. Only one of the boxes,—the standard,—could be opened by the animals. After a preliminary series of experiments during which the animals learned to select and open the standard box, this box was exposed in various combinations with the others, and the reactions of the animals,—dogs, cats and a squirrel,—were noted. It was found that all of the animals were able to distinguish between the six more prominent colors of the spectrum, and even between but slightly different tones of the same color. No color showed any pronounced superiority over any other. The results also show that the animals tested possess a rapid acquisition, and a fairly tenacious memory. (These two papers will appear in full in a forthcoming volume of the *Psychological Review* Monograph Series.)

In the session for Laboratory Methods of Research and Instruction the following papers were read:

*The Control of the Hipp Chronoscope in Psychometry*, by J. B. KRAUSE.

Experiments in the standardization of control-instruments showed that a fall-screen can be standardized so that it will mark off a time interval correct to .22σ, with a mean variation of less than .3σ. Tests with a pendulum showed that the constant and the variable error are approximately one-half as large as those of the fall-screen. Data were presented showing the degree of uniformity of reading which can be attained when the instrument is properly adjusted. In a series of 4,000 records taken in groups of 160,—comparison made between chronoscope and fall-screen at the end of each group,—the average difference between readings at the beginning and the end of groups was found to be  $\pm 1.008\sigma$ . In a smaller group of similar records with pendulum control the average difference was but  $\pm .36\sigma$ .

*A Finger Plethysmograph*, by HENRY H. GODDARD.

This new form of the instrument was designed to avoid two defects in plethysmographs now in use,—loss of time in adjusting to the body, and impossibility of reproducing exactly a former adjustment. The problem is solved by attaching the instrument to the thumb-nail by a clip, and then adjusting the pneumatic system to the ball of the thumb by means of an easily legible micrometer screw.

*Note on a New Method of Preparing Color Stimuli of a Definite Saturation, and its Application to the Study of Weber's Law*, by J. H. LEUBA.

Dr. Horn and Miss Blake, of Bryn Mawr College, have published the results of a series of colorimetric determinations wherein was employed a new and ingenious method of preparing chromatic stimuli. The stimuli were composed of light transmitted through filters filled with colored solutions of different composition, and at different degrees of concentration. The method is commendable in that it permits of an accurate reproduction and a minute gradation of stimuli. Professor Leuba demonstrated the method in detail, and pointed out that it furnishes the means for a new confirmation of Weber's Law. The application of the method gives results which show that, within limits, the amount of color solution which must be added to produce a just observable difference in color, is a constant fraction of the amount of color-substance already present.

*Student Apparatus for Courses in Experimental Psychology*, by E. B. TWITMYER.

A demonstration of the methods employed at the University of Pennsylvania. Each laboratory group is supplied with a set of apparatus which becomes the personal property of the students. Many of the instruments are designed by Dr. Twitmyer, and constructed by the laboratory mechanician; they are simple in design and remarkably efficient in operation. The plan and scope of the course was described in detail.

*A Demonstration of a Cheap but Efficient Air-Plethysmograph Constructed from a Lamp Chimney*, by E. C. SANFORD.

The glass fits over the hand; it is closed at one end (the wrist) by a thick bandage of putty, and at the other end by a cork fitted with glass tubes for pneumatic transmission, and for the equalization of air-pressure.

In the session given to Research Problems the papers read were as follows:

*Memory for Absolute Pitch*, by J. W. BAIRD.

Tests made upon a remarkable case of pitch memory were described. The eighty-eight notes of the piano, presented in difficult order, were identified with an average error of about four per cent. The distribution of errors showed the middle and upper regions of the key-board to be most readily identified,—a result which was confirmed by chronoscope records of reaction-times. The reproduction of tones by means of the voice, and the Stern *Tonvariator* showed a surprising degree of accuracy. Tests were made with tones of various clang-tints; pipe organ (flute, diapason, reed and other stops), *Tonvariator*, tuning-forks (mounted and unmounted), Galton whistle, bells, glasses, rods, etc. The discussion emphasized the importance of eliminating the participation of relative pitch memory (or 'sense of interval') in the investigation of absolute pitch memory. (This paper will appear in full in the *Monograph Supplements*.)

*The Fluctuation of Minimal Visual Stimuli*, by C. E. FERREE. (To be published in full in the *American Journal of Psychology*.)

*Experimental Studies of Reasoning Processes*, by E. C. SANFORD.

A demonstration of a convenient method for the experimental investigation of the reasoning processes. Puzzles of various sorts, and problems involving the simple arithmetical operations furnish especially appropriate material. An exercise in long division, for example, is worked out in full by the experimenter, who then erases certain figures from divisor, dividend, quotient, intermediate products and remainders, and substitutes crosses for the missing figures. The subject is asked to determine what figure is represented by each cross. Such exercises facilitate at once the inspection of the subject's reactions, and his introspection of his mental processes. The results show that habit plays a prominent rôle in the method of attacking a problem, and also marked individual variations of method (confirming the earlier work of Lindley). All reasoning processes show a tendency to conform to a type of association under limiting conditions of apperception. The logical type of the syllogism is a formula which applies to many sorts of things—as to reflex actions (Pierce)—and not at all a true description of the psychical experience of inference.

*Fluctuation of Attention to Cutaneous Stimuli*, by L. R. GEISSLER.

(Published in full in this number of the *American Journal of Psychology*.)

*The Method of Just Perceptible Differences*, by F. M. URBAN.

If a subject is required to make a series of comparisons between two stimuli,  $S_1$  and  $S_2$ , his judgments vary without any apparent order or regularity, so that one is unable to predict what the judgment will be in a given experiment; but in a great number of experiments each judgment tends to occur in a certain percentage of all the cases. This indicates the formal character of random events, and we introduce the notion of a probability of a judgment of a certain type. This means that there exists a definite probability that the comparison of the stimuli,  $S_1$  and  $S_2$ , will result in the judgment 'greater,' 'less' or 'equal.' These probabilities depend upon the amount of difference between the comparison-stimuli, and they may vary if the conditions under which the judgment is given are changed. An analysis of the experimental procedure which is called the method of just perceptible differences shows that for the just perceptible positive difference there exists the probability  $\frac{1}{2}$  that the judgment 'greater' will be given, and that there exists the probability  $\frac{1}{2}$  that on the just imperceptible positive difference the judgment 'greater' will not be given. Theoretically these differences are equal, and the cause of the differences which are always found in actual determinations is shown. Similar considerations hold for the just perceptible and the just imperceptible negative difference. The just perceptible negative difference is that amount of difference for which there exists the probability  $\frac{1}{2}$  that the judgment 'less' will be given, and the just imperceptible negative difference is that difference for which there exists the probability  $\frac{1}{2}$  that a 'less' judgment will not be given. The general notion of a just perceptible difference may, therefore, be defined as that amount of difference for which there exists the probability  $\frac{1}{2}$  that it will be recognized. Now the considerations which lead to these conclusions have certain practical consequences. The first and most important is, that one is not tied down to any specific order of presenting the pairs of comparison stimuli, if one records all the judgments. The second consequence is that one must not always use the same pairs of comparison-stimuli,

but that one must 'vary the steps by which one approaches the threshold.' One finds, too, that the accuracy of the method of just perceptible differences compares favorably with that of the method of right and wrong cases, and that it does not require the hypothesis of any specific law of distribution. From this it follows that the method of just perceptible differences is not only highly serviceable for all purposes which do not require a high degree of accuracy, in which cases there is little objection to using it in the form which is now in use, but also that it is capable of a high degree of accuracy. The theoretical considerations are illustrated by the results of experiments with lifted weights. The results of the computation are compared with the actual observations, and it is found that they coincide in a remarkably high degree, even when the number of observations is rather small.

*The Relation of the Four Taste Qualities to One Another*, by J. W. BAIRD.

The experimental method consisted in establishing the liminal concentrations of sugar, hydrochloric acid, sulphate of quinine and sodium chloride, which could, under normal conditions, be identified as sweet, sour, bitter and salt. Then after exhaustion of the taste organs by strong solutions of each, the subject was asked to identify subliminal solutions and distilled water. A procedure without knowledge was employed, and 5 ccm. of each solution was given,—the subject being required to wash the liquid about in the mouth cavity during the process of identification. Several interesting results were obtained. Water after sweet tasted sour, after sour and after bitter sweet, and after sweet bitter. Subliminal bitter was identified after fatigue with sweet, with salt and occasionally with sour. Subliminal sweet and salt were identified after exhaustion with bitter. These results indicate that bitter is not unrelated with the other taste qualities as Kiesow affirms.

*The Influence of Practice upon the Shortening of Reaction-Times (Sound Reactions)*, by CHARLES VUILLEUMIER.

Sixteen hundred reactions obtained from each of four subjects were treated by several statistical methods; the group averages and the mean variations all show the acquisition of celerity and uniformity of reaction with the progress of practice. The following table gives the averages of groups of 200 experiments for all four subjects, the results being averaged in groups of 200:

I.	II.	III.	IV.
117.06 $\sigma$	154.97 $\sigma$	163.15 $\sigma$	134.11 $\sigma$
108.62	135.77	139.07	128.23
102.6	111.83	129.95	123.75
98.4	108.83	130.24	124.23
96.4	99.77	128.51	111.44
91.1	95.98	108.54	106.81
92.2	96.73	113.7	103.78
94.07	102.1	111.43	108.65
Grand average, 100.04	113.24	128.07	117.32

The mean variations varied as follows:

16.57 $\sigma$	20.54 $\sigma$	21.97 $\sigma$	13.96 $\sigma$
14.49	13.67	12.58	12.41
12.14	10.93	11.62	12.19
11.89	9.08	10.12	9.85

9.40	7.77	9.09	9.59
10.59	8.04	9.92	9.09
10.33	7.47	9.77	9.95
9.77	8.86	9.07	8.88
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Grand average, 11.9	10.8	11.76	10.74

Practice shortens the reaction-time and it increases the number of those reactions which may be called normal.

At the meeting of the American Philosophical Society was presented the following paper:

*The Effect of Imperceptible Shadows on the Judgment of Distance*, by E. B. TITCHENER and W. H. PYLE.

This paper reported the results of a repetition and extension of the work published under the same title by Dunlap in 1900. The observer is asked to compare the lengths of two continuous sections of a horizontal black line upon a white ground. In certain series, unknown to the observer, the experimenter throws upon the background angular shadows, so disposed as to convert the two lengths of the line into the two parts of the Müller-Lyer illusion. The question at issue is whether the imperceptible shadows have any influence upon judgment.

It is shown, first, that these subliminal shadows, even raised almost to the limit of perceptibility, have no influence whatsoever upon the judgments of distance passed by five observers. It is shown further, that shadows, so weak as barely to hold their form distinct, exert an influence upon judgment, comparable with the influence exerted by strong shadows; there is no sliding scale of illusion-effect, varying with the clearness of contour of the illusion-motive. It is shown, thirdly, that the observer is able, by voluntary direction of attention, to resist the solicitation of a strong illusion-motive, clearly presented. So much the more then will he, under the conditions of Dunlap's experiments, resist the solicitation of an illusion-motive which he cannot see, of whose presence in the particular experiment he is ignorant, and which is left out of account in the instructions given him by the experimenter. It follows from the whole investigation that if the subconscious is to be received into experimental psychology at all, it must find some other means of access than these imperceptible shadows.

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